November 5, 2002

Mr. William T. Cottle
President and Chief Executive Officer
STP Nuclear Operating Company
South Texas Project Electric
Generating Station
P.O. Box 289
Wadsworth, TX 77483

SUBJECT: SOUTH TEXAS PROJECT, UNITS 1 AND 2 - REQUEST FOR RELIEF, RR-ENG-2-27, FROM AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE REQUIREMENTS FOR REPAIR/REPLACEMENT ACTIVITY OF CONTROL ROD DRIVE MECHANISM CANOPY SEAL WELDS (TAC NOS: MB6576 AND MB6577)

Dear Mr. Cottle:

By letter dated October 23, 2002, as supplemented by two letters dated October 31, 2002, South Texas Project Nuclear Operating Company (licensee), requested relief from the requirements of the 1989 Edition of American Society of Mechanical Engineers Code, Section XI, Article IWA-4000. Relief is requested from the requirement of IWA-4000, which would require liquid penetrant (PT) examination of a control rod drive mechanism canopy seal weld repair/replacement, for South Texas Project, Units 1 and 2. As an alternative to PT examination, the licensee has proposed to follow the guidelines of Code Case N-504-2, "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping," and will require a 5X VT-1 visual examination in lieu of the surface examination of the seal welds.

The licensee's basis for the request is that the Code-required repair method and the required surface examination of the seal welds would expose personnel to high radiation dose, which would create a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on its evaluation, the Nuclear Regulatory Commission (NRC) staff concludes that the Code-required repair method of the surface examination of the canopy seal welds would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee's proposed alternative described in Relief Request RR-ENG-2-27, Revision 1 is authorized for the second 10-year inservice inspection interval.

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation. Should you have any questions regarding this safety evaluation, please contact Mr. Mohan C. Thadani, at (301) 415-1476.

Sincerely,

/RA/

Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-498 and 50-499

Enclosure: Safety Evaluation

cc w/encl: See next page

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation. Should you have any questions regarding this safety evaluation, please contact Mr. Mohan C. Thadani, at (301) 415-1476.

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cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THE REQUEST FOR RELIEF NO. RR-ENG-2-27, REV. 1 SECOND 10-YEAR INTERVAL

INSERVICE INSPECTION PROGRAM PLAN

SOUTH TEXAS PROJECT, UNITS 1 AND 2

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

DOCKET NOS. 50-498 AND 50-499

1.0 INTRODUCTION

By letter dated October 23, 2002, as supplemented by two letters dated October 31, 2002, South Texas Project Nuclear Operating Company (licensee), requested relief from the requirements of the 1989 Edition of American Society of Mechanical Engineers (ASME) Code, Section XI, Article IWA-4000. Relief is requested from the requirement of IWA-4000, which would require liquid penetrant (PT) examination of a control rod drive mechanism (CRDM) canopy seal weld repair/replacement, for South Texas Project, Units 1 and 2. As an alternative to PT examination, the licensee has proposed to follow the guidelines of Code Case N-504-2, "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping," and will require a 5X VT-1 visual examination in lieu of the surface examination of the seal welds.

The repair of leaking seal welds would be performed using the guidelines of ASME Code Case N-504-2 which establishes acceptability of a repair by increasing the weld thickness and performing a 5X VT-1 visual examination and pressure verification test in lieu of the Code-required surface examination for final acceptance of the repaired weld. The licensee's basis for the request is that the Code-required repair method and the required surface examination of the seal welds would expose personnel to high radiation dose, which would create a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

The inservice inspection of ASME Boiler and Pressure Vessel Code (Code) Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by 10 CFR 50.55a(g), of Title 10 of the *Code of Federal Regulations* (10 CFR), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Regulation" require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The Code of record for the second 10-year inservice inspection (ISI) interval at South Texas Project Units, 1 and 2 is the 1989 Edition of Section XI of the ASME Code.

2.1 ASME Code Component Affected:

Reactor control rod drive mechanism canopy seal welds - Class 1 Appurtenance to the Reactor vessel.

2.2 Applicable Code Edition and Addenda:

ASME Code, Section XI, 1989 Edition with no Addenda. Designed and fabricated to the ASME Code, Section III, 1974 Edition through summer 1974 Addenda.

2.3 Applicable Code Requirements (as stated):

Article IWA-4000 of ASME Code, Section XI requires that repairs be performed in accordance with the Owner's original construction Code of the component or system, or later editions and addenda of the Code. The canopy seal weld is a Code seal weld as described in NB-4428 of Section III and requires a liquid PT examination of the final weld in accordance with NB-5271. IWA-4300 of Section XI requires that a defect be removed or reduced in size such that the resultant section thickness is equal to or greater than the minimum design thickness.

2.4 Reason for the Request (as stated):

During boric acid walkdown inspection of the Unit 2 ninth refueling outage (2RE09), STPNOC [South Texas Project Nuclear Operating Company] identified boric acid crystal buildup on a CRDM housing. Further investigation revealed evidence of minor leakage at the intermediate CRDM canopy seal weld on three separate housings. The CRDM canopy seal welds are located above the Reactor Vessel Closure Head, which is highly congested and subject to high radiation levels. The Code-required repair method would involve excavation of the defects and restoration to the original configuration. The Code repair method requires manual excavation of the defects and manual repair welding, and has a higher risk of failure due to the difficulty of making a quality weld on the canopy seal accompanied by the required back-purging and cleaning. In addition to the difficulty and time required to remove the defect and re-weld the canopy, a similar level of difficulty and resultant time is required for a PT examination of the weld repair. The high radiological dose associated with strict compliance with these requirements would be contrary to the intent of the ALARA [as low as reasonably achievable] radiological controls program. The PT examination would result in an estimated total dose of 1.487 person-Rem per CRDM canopy seal weld.

2.5 Proposed Alternative and Basis for Use (as stated):

STPNOC requests relief from the requirements of IWA-4000 in accordance with 10 CFR 50.55a (a)(3)(ii) by proposing an alternative method of repair and nondestructive examination due to hardship and unusual difficulty without a compensating increase in quality or safety. ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," will be used as guidance for repair by weld overlay by increasing the weld thickness to establish the acceptability of the defect in accordance with IWB-3640. In lieu of performance of PT examinations of CRDM seal weld repairs or replacement, a 5X visual (VT-1) examination and pressure verification testing will be performed after welding is completed. In addition, alloy 52 nickel-based weld repair material will be used rather than austenitic stainless steel as required by Code Case N-504-2.

The alternative method of repair is being requested to facilitate the repair during 2RE09 and to facilitate any future choice of using this repair option during the second 10-year ISI. The alternative nondestructive examination method is being requested to facilitate examination of either a repair or replacement of a CRDM canopy seal weld during the second 10-year ISI. The seal weld repair or replacement is required to be completed prior to plant startup following completion of 2RE09.

Industry experience with failure analyses performed on leaking canopy seal welds removed from service at other plants has attributed the majority of the cases to transgranular stress corrosion cracking (SCC). The size of the opening where leakage occurs has been extremely small, normally a few thousandths of an inch. The crack orientations vary, but often radiate outward such that a pinhole appears on the surface, as opposed to a long crack. The SCC results from exposure of a susceptible material to residual stress, which is often concentrated by weld discontinuities, and to a corrosive environment, such as water trapped in the cavity behind the seal weld that is mixed with the air initially in the cavity, resulting in higher oxygen content than is in the bulk primary coolant.

As allowed by the guidance of Code Case N-504-2, the CRDM canopy seal weld flaws will not be removed, but an analysis of the repaired weldment will be performed using Paragraph (g) of the Code case as guidance to assure that the remaining flaw will not propagate unacceptably. This analysis establishes the critical flaw size used to qualify the VT-1 examination method to ensure capability of detecting a flaw sufficiently small to assure an adequate margin of safety is maintained. The canopy seal weld is not a structural weld, nor a pressure-retaining weld, but provides a seal to prevent reactor coolant leakage if the mechanical joint leaks. The weld buildup is considered a repair in accordance with the ASME Code, Section XI, reference to the original Code of construction because the weld is performed on an appurtenance to a pressure-retaining component.

The alternative CRDM canopy seal weld repair uses a Gas Tungsten Arc Welding (GTAW) process and VT-1 examination controlled remotely. The VT-1 examination will use a video camera with approximately 5X magnification within several inches of the weld, qualified to ensure identification of a flaw significantly smaller than the analyzed critical flaw size. The examination technique will be demonstrated to resolve a 0.001" thick wire against the surface of the weld.

Alloy 52 nickel-base weld repair material was selected rather than austenitic stainless steel as required by Code Case N-504-2, Paragraph (b), for the repair because of its resistance to stress corrosion cracking. Consequently, the ferrite requirements of Code Case N-504-2, Paragraph (e) do not apply. The repair will be documented on Form NIS-2, reviewed by the Authorized Nuclear Inspector, and maintained in accordance with the requirements for archiving permanent plant records.

The GTAW weld repair and VT-1 examination methods result in significantly lower radiation exposure because the equipment is remotely operated after setup.

3.0 TECHNICAL EVALUATION

The licensee has proposed to perform the repair of leaking seal welds using the applicable provisions of ASME Code Case N-504-2, which establishes acceptability of a repair by increasing the weld thickness and performing a 5X VT-1 visual examination and pressure verification test, in lieu of the Code-required surface examination for final acceptance of the repaired welds. The Code case allows deposition of one or more layers of weld overlay to seal unacceptable indications in the area to be repaired without excavation. The Code case further requires an analysis of the repaired weldment to assure that the existing flaw will not propagate unacceptably for the design life of the repair, considering potential flaw growth due to fatigue and SCC, the mechanism believed to have caused the flaw. This analysis will establish a critical flaw size that can be used as a benchmark to qualify the VT-1 examination method to ensure the capability of detecting flaws of a size small enough to assure that an adequate margin of safety is maintained. Since the seal weld is neither a structural weld nor a pressure-retaining weld, the NRC staff finds the proposed alternative repair method to be acceptable. The licensee has also proposed to use Alloy 52 nickel-base weld repair material in place of austenitic stainless steel as required by Code Case N-504-2 due to its resistance to SCC and is therefore acceptable.

The proposed remote visual examination would be conducted using a video camera with 5X magnification and 0.001 inch resolution within several inches of the weld. The visual resolution of the video camera system has greater capability than that of the Code-required direct VT-1 visual examination of resolving a wire segment as narrow as 1/32-inch black line on an 18 percent neutral gray card. The licensee's proposed alternative is an enhanced visual examination technique with resolution and consistency much greater than that provided by the requirements of a Code (visually unaided) VT-1 and comparable to flaw sizes detectable using PT. Based on the capability of the remote visual examination system to resolve flaws of a size 0.001 inch in width, reasonable assurance of the weld integrity is provided.

The welding process consists of multiple layers of weld metal welded over the existing seal weld. The multiple layers of weld metal provide a redundant CRDM nozzle-to-canopy seal. Each layer is a seal of itself. The adequacy of the seal is verified with a routine system leakage test that is performed at normal operating temperature and pressure, and held at such conditions for a code-required soak time prior to returning to the system to service.

The licensee's basis for performing the remote 5X enhanced visual examination with a resolution of 0.001 inch in lieu of a PT is the dose saving that is anticipated to be achieved through the use of the remote visual examination process when compared to a manual PT examination process. The licensee estimated a total dose resulting from the performance of a PT examination on each weld repair to be in the range of 1.487 person-rem. This dose estimate represents the total amount that could be averted for the examination since the dose associated with setting up the remote visual examination system is included in the dose associated with installing and removing the GTAW apparatus. Based on the determination above that reasonable assurance of weld integrity is provided of the multiple layer seal weld by use of the remote visual examination and the pressure test, the radiation exposure associated with the performance of a Code-required surface examination, would not result in a compensating increase in the level of quality and safety.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the Code-required repair/replacement and the surface examination of the canopy seal welds would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the staff authorizes the proposed alternative stated in Relief Request RR-ENG-2-27, Revision 1 for South Texas Project, Units 1 and 2, for the second 10-year ISI interval.

Principal Contributor: Pat Patnaik

Date: November 5, 2002

South Texas, Units 1 & 2

cc:

Mr. Cornelius F. O'Keefe
Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 910
Bay City, TX 77414

A. Ramirez/C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

Mr. M. T. Hardt
Mr. W. C. Gunst
City Public Service Board
P.O. Box 1771
San Antonio, TX 78296

Mr. C. A. Johnson/R. P. Powers
AEP - Central Power and Light Company
P.O. Box 289
Mail Code: N5022
Wadsworth, TX 77483

INPO
Records Center
700 Galleria Parkway
Atlanta, GA 30339-3064

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

D. G. Tees/R. L. Balcom
Texas Genco, LP
P.O. Box 1700
Houston, TX 77251

Judge, Matagorda County
Matagorda County Courthouse
1700 Seventh Street
Bay City, TX 77414

A. H. Gutterman, Esq.
Morgan, Lewis & Bockius
1111 Pennsylvania Avenue, NW
Washington, DC 20004

Mr. T. J. Jordan, Vice President
Engineering & Technical Services
STP Nuclear Operating Company
P.O. Box 289
Wadsworth, TX 77483

S. M. Head, M
Manager, Licensing
Nuclear Quality & Licensing Department
STP Nuclear Operating Company
P.O. Box 289, Mail Code: N5014
Wadsworth, TX 77483

Environmental and Natural Resources
Policy Director
P.O. Box 12428
Austin, TX 78711-3189

Jon C. Wood
Matthews & Branscomb
112 East Pecan, Suite 1100
San Antonio, TX 78205

Arthur C. Tate, Director
Division of Compliance & Inspection
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756

Brian Almon
Public Utility Commission
William B. Travis Building
P.O. Box 13326
1701 North Congress Avenue
Austin, TX 78701-3326

Susan M. Jablonski
Office of Permitting, Remediation and Registration
Texas Commission on Environmental Quality
MC-122
P.O. Box 13087
Austin, TX 78711-3087

G. R. Bynog, Program Manager/ Chief Inspector
Texas Department of Licensing and Regulation
Boiler Division
P.O. Box 12157, Capitol Station
Austin, TX 78711

Mr. Ted Enos
4200 South Hulen
Suite 630
Ft. Worth, Texas 76109